Limited Visual Dam Safety Inspection Summary Report

HI - 00040

Waikoloa 50 MG Reservoir 1

Hawaii, Hawaii

Prepared by:

U.S. ARMY CORPS OF ENGINEERS
HONOLULU ENGINEER DISTRICT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

May 2006

Dam ID: HI00040
Name: Waikoloa 50 MG Reservoir 1

Limited Visual Dam Safety Inspection Conducted on: 7 April 2006

I. Purpose:

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections were authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statues, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections were conducted under joint agreements of the U.S. Army Corps of Engineers (ACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection was performed on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works included the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may or may not have appeared to be any immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

V. Inspection Team

Organization	Name
U.S. Army Corps of Engineers	Troy Cosgrove
National Resources Conservation Service	Sherman White

VI. Owner's Representatives Present

Mr. Bill Yamamoto, Hawaii County Water Department

VII. Summary Report Team

Organization	Name
U.S. Army Corps of Engineers	Derek Chow
	Mr. Joseph Koester
State of Hawaii, Dept. of Land and Natural Resources	Denise Manuel
	Edwin Matsuda

VIII. Dam Type

The dam is an earthen embankment.

IX. Dam Classification

The current hazard classification of this dam is: High
Based on available data, this classification is believed to still be applicable.

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Small

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

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X. Summary of Inspection:

Condition Rating Criteria: The conditional terms in this report are used to generally described the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

A. General appearance:

The reservoir and dam features were easily recognizable. The dam appears to have a small drainage area.

Modifications / Improvements: There were no signs of any recent modifications. Based on staff personnel, this reservoir has no incident history.

Findings and Corrective Actions:

a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
b. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
c. Routine inspection logs were not inspected.
d. Dam owners shall provide for routine inspection of the dam.
e. Access to site appears to be satisfactory.
f. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
g. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
h. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
i. Emergency Alarms / Monitors: There were no alarms or monitors observed on this reservoir.
j. Power / Communication: There were no communication systems observed on this reservoir. There were no utility or power poles visible nearby.

B. Access / Security:

Access to the dam was accomplished via a County roadway.
A four wheel drive vehicle is not required.

Security issues: Valves are locked. Access to the dam is via several locked gates.

C. Inflow Works:

The inflow works consist of a single, 16 inch diameter ductile iron pipe.
The intake or inlets have the ability to be shut off or diverted away from the reservoir during periods of heavy rains. This is done manually.

Findings and Corrective Actions:

a. The intake works were not tested.
b. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.

D. Reservoir

The reservoir level during the inspection was 31.5 ft per a staff gage marked on an access ladder.
According to staff personnel, the reservoir is normally operated for water supply below the dam, and is kept within normal range.
The reservoir is typically full, as it was on the day of inspection.

Findings and Corrective Actions:

a. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.

E. Upstream Slope (Satisfactory)

The upstream slope varied in slope and ranged from 1V: 2H (Vertical/Horizontal).
The slope was concrete lined.
No erosions, cracks, or sinkholes were observed.

Findings and Corrective Actions:

a. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

F. Crest: (Satisfactory)

The dam crest was approximately 20 feet wide There was a grassed access road on top of the crest that appeared to be occasionally utilized. There was low vegetation on either edge of the crest. No erosion was observed, nor were cracks or sinkholes.

Findings and Corrective Actions:

a. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.

G. Downstream Slope: (Fair)

There was no slope protection observed on the downstream slope.
Small gully erosion was observed on the downstream slope, on the north side; the gully was 12 inches wide and 6-12 inches deep. Sinkholes were not observed on the downstream slope. Vegetation was observed on the downstream slope. The majority of the vegetation was low ground cover, with 23 woody trees less than 6 inches diameter. Seepage was not observed on the downstream toe.

Findings and Corrective Actions:

a. The downstream slope appeared to be in fair to poor condition and requires corrective action.
b. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: described above
c. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

H. Abutments / Toe: (Fair)

Erosion along the abutment or toe was not observed. Two areas were noted along the toe that could be possible seepage spots. These locations were observed: (1) near the east side of the reservoir, which could not be determined as to flow due to wet conditions; and (2) in the northern area, near inlet piping, as evidenced by iron staining. Green, lush vegetation indicated both potential seeps.

Findings and Corrective Actions:

a. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
b. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
c. Clear debris from toe area on north side to ease inspection.

I. Outlet Works: (Satisfactory)

Outlet works were inspected, but not tested. The outlet works appeared to be a 24" ductile iron pipe, underground. The outlet works was controlled via a gate valve on the downstream side of the dam.

Findings and Corrective Actions:

a. The outlet works were not tested.
b. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

J. Spillway: (Satisfactory)
This spillway consisted of an ungated, concrete lined channel.
The rough dimensions were 45 ft length by 60 ft width at the dam centerline.
The spillway channel runs perpendicularly from the dam and is unlined.
The invert elevation is 3332.9 ft.
The spillway approach was clear.
There was no erosion observed near the spillway.
The downstream vegetation appears to be primarily low ground cover.

Findings and Corrective Actions:
a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.

K. Down Stream Channel: (Unknown)
The down stream channel was not investigated; the reservoir drains to the Waikoloa stream.

Findings and Corrective Actions:
a. The downstream channel was not inspected.

XI. Additional Comments:

Original field inspection notes were scanned and are attached to this summary report. Included are several photos from the site visit to detail important features of the project, captioned to be self-explanatory.

Per e-mail dated 4/27/2006 10:25 am from Troy Coserove, USACE.
Reservoir:
My understanding was that the there was not a range, but the reservoir is operated at a steady level of 31.5 ft.
Crest: The roadway was grass in good condition, 20 ft wide and used ocationally.
Downstream slope: Seepage was at the toe and not the downstream slope.
Downstream channel:
The is not a downstream area. The reservoir flow via an underground pipe to a water treatment plant. The Waikoloa- off stream came from one of the documents that was one hand, I believe it was the USACE binder.
Comments:
The dam doe not present a threat. Seepage should be monitored. (near the abutment/toe area) If seepage increases or continues an investigation would be warranted.
How bad is the seepage? There is some standing water with iron staining and wet ground. There is no heavy flow or material transport.
Would it create a structural problem? If it gets worse yes, but currently no.

PHOTOGRAPHS

Dam ID: HA-040
Name: Waikoloa 50 MG Reservoir 1

Photo 1 Spillway looking downstream.

Photo 2 North side downstream slope.

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Photo 3 Downstream toe seep area 1.

Photo 4 Outlet works valve box.

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Photo 5 Downstream slope.

Photo 6 Reservoir overview.

Photo 7 Reservoir gage.

Photo 8 Downstream slope erosion.

Photo 9 Intake piping and valves.

Photo 10 Upstream slope.

Photo 11 Aerial overview of reservior.

FIELD INSPECTION SHEETS

Dam ID: HA-0040
WAIKOLOA 50 MG RESERVOIR 1

Vulnerability Index:
Extreme 1 | High 2 | Moderate 3 | Low 4

Inspection No: _____
Date: 4/7/06

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Inspection Type: Visual Dam Safety Inspection

Persons Present	Affiliation	Phone Number
Troy Cosgrove	US Army Corps of Engineers	
Sherman White	NRCS	
Bill Yamamoto	Hawaii County Water Dept	

Weather Condition: ☐ Rain previous day ☑ Rainy ☐ Drizzle / Mist ☐ Cloudy/Overcast ☐ Partly Cloudy ☐ Sunny ☐ Dry

Comments: _____

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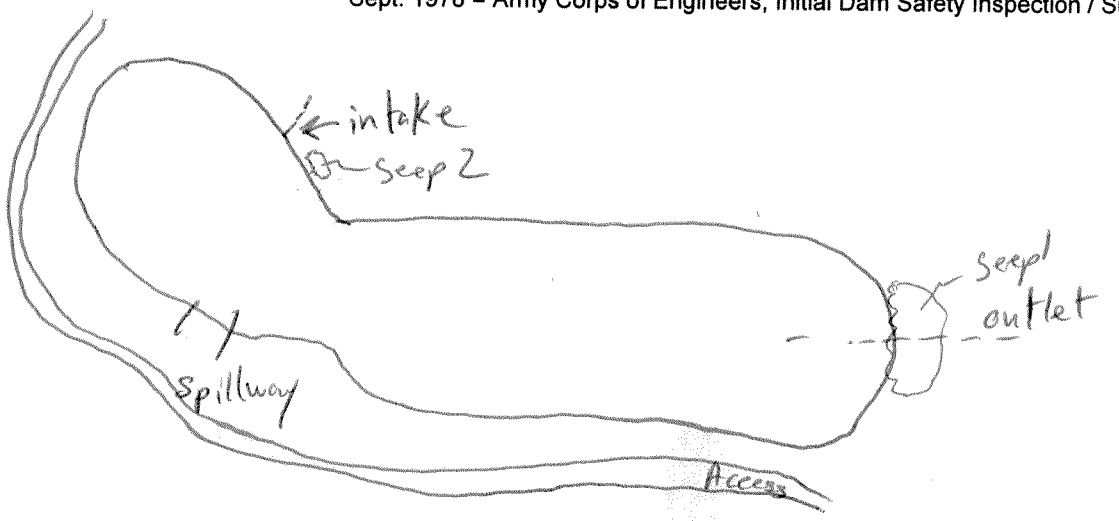
1. General: *(Information currently on file, update as required)*

Dam/Res. Name: WAIKOLOA 50 MG RESERVOIR 1
Owner: Hawaii County, Department of Water Supply *(C011)*
Owner Contact: Mr. Kurt Inaba — Owner Ph. _
Lessee: N/A — Lessee Ph. _
O & M Contractor: Hawaii County — O & M Ph. _
Nearest Town: WAIMEA — Latitude: 20.04 ° (decimal)
County: HAWAII — Longitude: 155.6767 ° (decimal)
Tax Map Key(s): (3)6-5-001:047

Dam Status	A:	Hazard Potential	H:	Dam Size	
Year Completed	1970	Dam Length	1700 ft.	Dam Height	38 ft.
Normal Storage	157 ac.ft.	Max. Storage	190 ac.ft.	Max. Surface Area	6.7 ac.
Drainage Area	mi.	Spillway Type		Max. Spillway Q	160 cfs

Owner owns land under dam facility: _____
Emergency Action Plan on file with the Department: NO
Reports on file with the Department: July 1996 = Dam Safety Inspection, Woodward Clyde (7)
Sept. 1978 = Army Corps of Engineers, Initial Dam Safety Inspection / Survey (2)



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WAIKOLOA 50 MG RESERVOIR 1

Inspection No: _____
Date: 4/4/06

2. Questions for Owner's Rep.:

	Yes	No	Unknown	Comments
Construction Plans Available	☑	☐	☐	
Site / Facility Map	☑	☐	☐	
Operation & Maintenance Manual	☐	☐	☑	
Emergency Action Plan	☐	☐	☑	
Modifications / Improvements	☐	☑	☐	
Conduct Routine Inspections	☑	☐	☐	
Conduct Routine Maintenance	☑	☐	☐	
Vehicle access to site	☑	☐	☐	☐ Not accessible ☑ With Standard car ☐ Requires 4-Wheel Drive
Access during heavy rains	☑	☐	☐	☐ Not accessible ☑ With Standard car ☐ Requires 4-Wheel Drive
Access when spillway is flowing	☑	☐	☐	☐ Not accessible ☑ With Standard car ☐ Requires 4-Wheel Drive
Other Studies Conducted	☐	☐	☑	☐ Phase I ☐ Phase II ☐ Hydraulics ☐ Stability ☐ Hazard ☐ Seismic ☐ Other: _____
Incident History	☐	☑	☐	☐ Breached ☐ Overtop ☐ Slide ☐ Down stream Flooding ☐ Other: _____
Reservoir's Current Use	☑	☐	☐	☐ Sediment ☐ Irrigation ☐ Recreation ☐ Flood Control ☑ Drinking Water ☐ Power Generation ☐ Other: _____

Findings and Corrective Actions:

- ☑ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☑ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- ☐ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☑ f. Routine inspection logs were not inspected.
- ☑ g. Dam owners shall provide for routine inspection of the dam.
- ☐ h. The dam did not appear to be maintained on a regular basis.
- ☑ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☑ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☑ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- ☑ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required	Recommended	
☐	☐	Phase I Study
☐	☐	Phase II Study (Including ☐ Seepage ☐ Hydrology/Hydraulics ☐ EAP)
☐	☐	Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity)
☐	☐	Stability Analysis
☐	☐	Seismic Analysis
☐	☐	Hazard Classification
☐	☐	Other: _____

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WAIKOLOA 50 MG RESERVOIR 1

Inspection No: _____
Date: 4/7/16

Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

3. Reservoir:

Level during inspection 31.5 ft per gage (gage / other)

Normal Operating Level/Range within range ft per gage (gage / other)

Description: Operated for water supply below spillway

Typical Operation ☐ Spillway always flowing ☑ Kept within normal range ☐ Kept Empty ☐ Drained Daily ☐ Only filled by Storms

☐ Other: _____

Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep ☑ Not Visible ☑ None Observed

Description: reservoir full

Staff Gage: Description: marked on access ladder.

Findings:

- ☐ a. The reservoir was not inspected.
- ☑ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The reservoir appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ e. The staff gage needs maintenance and/or repair. Description: _____
- ☐ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.
- ☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.
- ☐ h. _____

4. Intake Works Description:

☑ Number of Intakes 1

☑ Intake Culvert / Pipe

Size: 16 in. ☑ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control: ☐ Gate ☑ Valve ☑ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☑ Reservoir ☐ Other _____

☐ Ditch / Flume

Dimension: _____ (Size x Depth) Shape _____

Surface: ☐ Dirt ☐ Wood ☐ Concrete ☐ Lined w/ _____

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

Findings:

- ☐ a. The intake works were not inspected.
- ☑ b. The intake works were not tested.
- ☑ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time. @ surface
- ☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ f. The intake works needs maintenance and/or repair. Description: _____
- ☐ g. _____

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5. Upstream Slope: **(Typical Slope ±** 1V : 2H**)**

Slope Protection: ☐ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☑ Liner concrete ☐ Other: _____
☐ Defect in Protection: Description: _____

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☑ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

- ☐ a. The upstream slope was not inspected.
- ☑ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The upstream slope appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ k. _____

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6. Crest: Approximate Crest Width: 20ft

Access: ☐ None ☐ Walking Path ☑ Roadway, Surface / Width / Usage: grass, 20ft, ocean/

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☑ None Observed

Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Findings:

- ☐ a. The dam crest was not inspected.
- ☑ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The dam crest appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Access along the crest was satisfactory.
- ☐ f. Access along the crest was not possible. Description: _____
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. _____

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7. Downstream Slope: **(Typical Slope ± 1V : 2H)**

Access: ☐ lower roadway along toe ☑ roadway to outlet works ☑ walkway to outlet works ☐ None Observed

Slope Protection: ☑ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ Concrete

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☑ Gully (>6" deep) ☐ Not Visible ☐ None Observed

Description: Small gullies North side 12"wide and 12-6" deep down slope

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☑ None Observed

Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☑ Trees # 23 ☑ <6" ☐ >6" & <20" ☐ >20"

Description: Tree + stump to be removed

Seepage:

Seep Spot Number 1

☑ Green Vegetation ☑ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description: _____

Water Clarity: ☑ Clear ☐ Some particles ☐ Muddy ☑ Other: Iron stained

Description: Wet area

TTC

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

☐ a. The downstream slope was not inspected.

☐ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

☑ c. The downstream slope appeared to be in fair to poor condition and requires corrective action.

☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____

☑ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: fill compact, regrite gully

☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.

☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.

☐ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☑ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.

☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.

☐ k. _____

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8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Seepage:
Seep Spot Number 1
☑ Green Vegetation ☑ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed
☐ Flowing, Description: _____
Water Clarity: ☑ Clear ☐ Some particles ☐ Muddy ☑ Other: Iron staining
Description: Seep on the east side of reservior, could not identify if flowing due to wet conditions

Seep Spot Number 2
☑ Green Vegetation ☑ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed
☐ Flowing, Description: _____
Water Clarity: ☑ Clear ☐ Some particles ☐ Muddy ☑ Other: Iron staining
Description: Seep on north side near inlet piping

Findings:

☐ a. The abutments/toe were not inspected.
☐ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
☑ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____
☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____
☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☑ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
☑ l. Clear debris from toe area on North side to ease inspection

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9. Outlet Works:

Culvert / Pipe

Type / Size: 24" Pipe under ground

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other _____

Pipe: ☑ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control Type: ☐ Gate ☑ Valve ☐ Other _____

Location: ☐ Control on Upstream side ☑ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☑ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

TJC
- ☑ a. The outlet works were not inspected.
- ☑ b. The outlet works were not tested.
- ☑ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.
- ☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. _____
- ☐ j. _____

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10. Spillway:

Type: ☐ None ☐ Culvert/Pipe ☑ Channel
Description: Ungated concrete lined

Dimension: 45 x 60 ft. Invert elevation: 3332.9 ft. ~~per staff gage~~ elevation

Slope Protection: ☐ None ☑ Grass ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Concrete
☐ Defect in Protection: Description: _____

Approach: ☑ Clear ☐ High Veg. ☐ Trees ☐ Other: _____

Erosion: ☐ Scour ☐ Gully ☐ Headcut ☑ Not Observed ☐ Other: _____
Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

☑ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
☐ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ d. Slope protection needs maintenance or repair. Description: _____
☐ e. The spillway approach was blocked. Clear approach.
☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____
☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.
☐ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
☐ j. _____

11. Down Stream Channel:

Name: Waikoloa-off stream

Downstream: ☐ Sump ☐ Open Area ☐ Un-Defined Drainage-way ☐ Defined Drainage-way ☐ Other _____

Items along Stream Bank: ☐ None ☐ Road ☐ Houses ☐ Town ☑ Not Inspected

Description: _____

Findings:

☑ a. The downstream channel was not inspected.
☐ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. _____

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Additional Comments:

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statures Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.

Revised: Dec. 1, 2003